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(050v)

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION
(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark
Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year)
08 February 2001 (08.02.01)

International application No.
PCT/SE00/00522

Applicant's or agent's file reference

International filing date (day/month/year)
17 March 2000 (17.03.00)

Priority date (day/month/year)
19 March 1999 (19.03.99)

RECEIVED

Applicant

APR 13 2001

SAGEFALK, Willy et al

Technology Center 2100

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

27 September 2000 (27.09.00)

in a notice effecting later election filed with the International Bureau on:

2. The election was was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

R. E. Stoffel

Telephone No.: (41-22) 338.83.38

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only	
International Application No.	
International Filing Date	
Name of receiving Office and "PCT International Application"	
Applicant's or agent's file reference (if desired) (12 characters maximum)	

Box No. I TITLE OF INVENTION A DIGITAL CAMERA HAVING PANNING AND/OR TILTING FUNCTIONALITY; AND AN IMAGE ROTATING DEVICE FOR SUCH A CAMERA

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Axis AB
Schelevägen 16
S-223 70 LUND
Sweden

This person is also inventor.

Telephone No.

Faximile No.

Teleprinter No.

State (that is, country) of nationality:
Sweden

State (that is, country) of residence:
Sweden

This person is applicant for the purposes of: all designated States all designated States except the United States of America the United States of America only the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

SAGEFALK, Willy
Möllevångsvägen 8
S-222 40 LUND
Sweden

This person is:

applicant only

applicant and inventor

inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:
Sweden

State (that is, country) of residence:
Sweden

This person is applicant for the purposes of: all designated States all designated States except the United States of America the United States of America only the States indicated in the Supplemental Box

Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

agent common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

Ström & Gulliksson AB (Any of Tore Ström,
Jonas Gulliksson, Stellan Petri, Leif
Karlsson and Björn Andersson)
P O Box 4188
S-203 13 Malmö
Sweden

Telephone No.

+46 40 757 45

Faximile No.

+46 40 23 78 97

Teleprinter No.

Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

See Notes to the request form

Sheet No. 2.....

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

ABRAHAMSSON, Lars
Videgatan 1B
S-582 46 LINKÖPING
Sweden

This person is:

applicant only
 applicant and inventor
 inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:
Sweden

State (that is, country) of residence:
Sweden

This person is applicant for the purposes of: all designated States all designated States except the United States of America the United States of America only the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

applicant only
 applicant and inventor
 inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: all designated States all designated States except the United States of America the United States of America only the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

applicant only
 applicant and inventor
 inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: all designated States all designated States except the United States of America the United States of America only the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

applicant only
 applicant and inventor
 inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: all designated States all designated States except the United States of America the United States of America only the States indicated in the Supplemental Box

Further applicants and/or (further) inventors are indicated on another continuation sheet.

See Notes to the request form

Sheet No. 3

Box No. V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

AE United Arab Emirates

AL Albania

AM Armenia

AT Austria

AU Australia

AZ Azerbaijan

BA Bosnia and Herzegovina

BB Barbados

BG Bulgaria

BR Brazil

BY Belarus

CA Canada

CH and LI Switzerland and Liechtenstein

CN China

CU Cuba

CZ Czech Republic

DE Germany

DK Denmark

EE Estonia

ES Spain

FI Finland

GB United Kingdom

GD Grenada

GE Georgia

GH Ghana

GM Gambia

HR Croatia

HU Hungary

ID Indonesia

IL Israel

IN India

IS Iceland

JP Japan

KE Kenya

KG Kyrgyzstan

KP Democratic People's Republic of Korea

KR Republic of Korea

KZ Kazakhstan

LC Saint Lucia

LK Sri Lanka

LR Liberia

LS Lesotho

LT Lithuania

LU Luxembourg

LV Latvia

MD Republic of Moldova

MG Madagascar

MK The former Yugoslav Republic of Macedonia

MN Mongolia

MW Malawi

MX Mexico

NO Norway

NZ New Zealand

PL Poland

PT Portugal

RO Romania

RU Russian Federation

SD Sudan

SE Sweden

SG Singapore

SI Slovenia

SK Slovakia

SL Sierra Leone

TJ Tajikistan

TM Turkmenistan

TR Turkey

TT Trinidad and Tobago

UA Ukraine

UC Uganda

US United States of America

UZ Uzbekistan

VN Viet Nam

YU Yugoslavia

ZA South Africa

ZW Zimbabwe

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

.....

.....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

Sheet No. 4.....

Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 19.03.1999	9901038-1	Sweden		
item (2)				
item (3)				

The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present International application is the receiving Office) identified above as item(s):

* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA)
(if two or more International Searching Authorities are competent to carry out the International search, indicate the Authority chosen; the two-letter code may be used):

ISA / SE

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year) Number Country (or regional Office)

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following number of sheets:

request : 4
description (excluding sequence listing part) : 7
claims : 2
abstract : 1
drawings : 4
sequence listing part of description : 1

Total number of sheets : 18

This international application is accompanied by the item(s) marked below:

- fee calculation sheet
- separate signed power of attorney
- copy of general power of attorney; reference number, if any:
- statement explaining lack of signature
- priority document(s) identified in Box No. VI as item(s):
- translation of international application into (language):
- separate indications concerning deposited microorganism or other biological material
- nucleotide and/or amino acid sequence listing in computer readable form
- other (specify):

Figure of the drawings which should accompany the abstract: 1

Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Note to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Malmö, March 16, 2000

Ström & Gulliksson AB



Björn Andersson

For receiving Office use only

1. Date of actual receipt of the purported international application:	2. Drawings:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	<input type="checkbox"/> received: <input type="checkbox"/> not received:
4. Date of timely receipt of the required corrections under PCT Article 1(2):	
5. International Searching Authority (if two or more are competent): ISA /	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau:	See Notes to the request form
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This sheet is not part of and does not count as a sheet of the international application.

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FEES CALCULATION SHEET

Annex to the Request

Applicant's or agent's
file reference **W 3313-048**

For receiving Office use only

International application No.

Date stamp of the receiving Office

Applicant

Axis AB

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE

1000

T

2. SEARCH FEE

8510

S

International search to be carried out by **SE**
(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains _____ sheets.

first 30 sheets **3540**

b1

remaining sheets **x** additional amount **b2**

Add amounts entered at b1 and b2 and enter total at B **3540**

B

Designation Fees
The international application contains _____ designations.

8 **x** **760** = **6080**

D

number of designation fees amount of designation fee
payable (maximum 10)

9620

I

Add amounts entered at B and D and enter total at I
(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT (if applicable)

5. TOTAL FEES PAYABLE

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

19130

TOTAL

The designation fees are not paid at this time.

MODE OF PAYMENT

authorization to charge
deposit account (see below)
 cheque
 postal money order

bank draft
 cash
 revenue stamps

coupons
 other (specify):

DEPOSIT ACCOUNT AUTHORIZATION (this mode of payment may not be available at all receiving Offices)

The ROU _____

is hereby authorized to charge the total fees indicated above to my deposit account.

(This check-box may be marked only if the conditions for deposit accounts of the receiving Office so permit) is
hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my
deposit account.

is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International
Bureau of WIPO to my deposit account.

Deposit Account No.

Date (day/month/year)

Signature

Comments to the fee calculation

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT



(PCT Article 36 and Rule 70) 14

Applicant's or agent's file reference W3313-048	FOR FURTHER ACTION		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/SE00/00522	International filing date (day/month/year) 17/03/2000	Priority date (day/month/year) 19/03/1999	
International Patent Classification (IPC) or national classification and IPC G03B37/00			
			RECEIVED OCT 04 2001
Applicant AXIS AB Technology Center 2600			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

Date of submission of the demand 27/09/2000	Date of completion of this report 15.06.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Artelsmair, G Telephone No. +49 89 2399 8989



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/SE00/00522

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-7 as originally filed

Claims, No.:

1-3 as received on 11/05/2001 with letter of 11/05/2001

Drawings, sheets:

1-4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/SE00/00522

the drawings, sheets:

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c));
(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims 1-3
	No: Claims
Inventive step (IS)	Yes: Claims 1-3
	No: Claims
Industrial applicability (IA)	Yes: Claims 1-3
	No: Claims

**2. Citations and explanations
see separate sheet**

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/SE00/00522

- 1 The application relates to a digital camera having a panning/tilting functionality.
- 2 Nearest prior art is US-A-3868706 (D1) which describes a camera according to the preamble of claims 1 and 3.

A similar device is known from US-A-4499490 (D2).

The other documents cited in the ISR only relate to the general technological background.

- 3 Concerning claim 1:

In the prior art cameras as described in D1 or D2 there arises the problem that when the mirror is rotated the image produced by the camera will become distorted. According to claim 1 this problem is solved by the provision of image transforming means which means are adapted to rotate the digital image by an angle related to the angle of rotation of the mirror.

Although image transformation of digital images is known per se for different purposes there is no indication in the cited prior art which would make it obvious for a skilled person to use image transformation means in a camera with panning/tilting functionality in order to automatically compensate for image rotating effects.

- 4 Concerning claim 3:

The subject-matter of claim 1 differs from what is described in D1 or D2 in that a second mirror mounted externally to the camera housing and a second rotational member for rotating the second mirror is foreseen. This arrangement allows a more compact design and a wider field of view. Since all the cameras described in the cited prior art are single mirror devices it is difficult to argue that the arrangement according to claim 3 could be derived in an obvious manner from the available prior art.

CLAIMS

1. A digital camera (300) having panning and/or tilting functionality, comprising: a camera housing (6) with an optical input (400), such as a lens or objective (8); an image capturing unit (500) for producing a digital image from light received through the optical input; a controller (600); a first mirror (9) mounted externally to the camera housing (6); and an image rotating device (200), which is connected to the controller (600) and is adapted to rotate the first mirror at an angle of rotation with respect to the optical axis of the input (400, 8) of the camera housing (6), characterized by

15 an image transforming unit (800), which is connected to the image capturing unit (500) and is adapted to rotate the digital image, as captured by the image capturing unit (500), by an angle related to the angle of rotation of the first mirror (9).

20 2. A digital camera as in claim 1, further comprising a second mirror (10) mounted externally to the camera housing (6), wherein the image rotating device (200) is adapted to rotate the second mirror at a second angle of rotation with respect to the optical input (400, 8) of the camera housing (6).

30 3. An image rotating device (200) for a digital camera (300) having a camera housing (6), an optical input (400), such as a lens or objective (8), and an image capturing unit (500) for producing a digital image from light received through the optical input, the image rotating device comprising a first mirror (9) mounted externally to the camera housing (6), and a first rotational member (5, 7) for rotating the first mirror at a first angle of

11-05-2001

PCT/SE00/00522

010510 W:\3323040 amended PCT claims.doc 3A/35

CLMS

9

rotation with respect to the optical axis of the input (400, 8) of the camera housing, characterized by a second mirror (10) mounted externally to the camera housing (6); and

5 a second rotational member (3, 7) for rotating the second mirror at a second angle of rotation with respect to the optical input (400, 8) of the camera housing, wherein the first and second mirrors are arranged along a common optical axis.

10



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : G03B 37/00		A1	(11) International Publication Number: WO 00/57246 (43) International Publication Date: 28 September 2000 (28.09.00)
<p>(21) International Application Number: PCT/SE00/00522</p> <p>(22) International Filing Date: 17 March 2000 (17.03.00)</p> <p>(30) Priority Data: 9901038-1 19 March 1999 (19.03.99) SE</p> <p>(71) Applicant (for all designated States except US): AXIS AB [SE/SE]; Schelevägen 16, S-223 70 Lund (SE).</p> <p>(72) Inventors; and</p> <p>(75) Inventors/Applicants (for US only): SAGEFALK, Willy [SE/SE]; Möllevångsvägen 8, S-222 40 Lund (SE). ABRAHAMSSON, Lars [SE/SE]; Videgatan 1B, S-582 46 Linköping (SE).</p> <p>(74) Agents: STRÖM, Tore et al.; Ström & Gulliksson AB, P.O. Box 4188, S-203 13 Malmö (SE).</p>		<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>	
<p>(54) Title: A DIGITAL CAMERA HAVING PANNING AND/OR TILTING FUNCTIONALITY, AND AN IMAGE ROTATING DEVICE FOR SUCH A CAMERA</p> <p>(57) Abstract</p> <p>A digital camera (300) has panning and/or tilting functionality and comprises: a camera housing (6) with an optical input (400), such as a lens or objective (8); an image capturing unit (500) for producing a digital image from light received through the optical input; and a controller (600). A first mirror (9) is mounted externally to the camera housing (6). An image rotating device (200) receives an angular displacement control signal from the controller (600) and rotates the first mirror at an angle with respect to the optical input (400, 8) of the camera housing (6).</p>			
<pre> graph TD Object100([Object 100]) --> IRD200[Image Rotating Device 200] IRD200 --> DCamera300[Digital camera 300] subgraph DCamera300 Controller600[Controller 600] Objective400[Objective 400] ICU500[Image Capturing Unit 500] ITU800[Image Transforming Unit 800] Memory700[Memory 700] Controller600 --> Objective400 Controller600 --> ICU500 Objective400 --> ICU500 ICU500 --> ITU800 ICU500 --> Memory700 ITU800 --> Network900[Network 900] end </pre>			

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
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BJ	Benin	IL	Israel	MR	Mauritania	UA	Ukraine
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CA	Canada	JP	Japan	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	KE	Kenya	NL	Netherlands	VN	Viet Nam
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CH	Switzerland	KP	Democratic People's Republic of Korea	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KR	Republic of Korea	PL	Poland		
CM	Cameroon	KZ	Kazakhstan	PT	Portugal		
CN	China	LC	Saint Lucia	RO	Romania		
CU	Cuba	LI	Liechtenstein	RU	Russian Federation		
CZ	Czech Republic	LK	Sri Lanka	SD	Sudan		
DE	Germany	LR	Liberia	SE	Sweden		
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**A DIGITAL CAMERA HAVING PANNING AND/OR TILTING
FUNCTIONALITY, AND AN IMAGE ROTATING DEVICE FOR SUCH A
CAMERA**

5 **Technical Field**

The present invention relates to a digital camera having panning and/or tilting functionality, and more specifically to a digital camera having a camera housing with an optical input, such as a lens or objective, an 10 image capturing unit and a controller. The invention also relates to an image rotating device for providing the panning and/or tilting functionality of such a digital camera.

15 **Background Art**

A common example of a digital camera with panning and/or tilting functionality is a web camera, which e.g. may be mounted at a given location for the purpose of surveillance, production monitoring, etc. The web camera 20 comprises an optical input in the form of a lens or objective and an image capturing unit for producing a digital image from light received from the optical input. Usually, the image capturing unit comprises a CCD element (Charge Coupled Device). The web camera has software and 25 hardware for allowing the camera to be connected to a given network, such as an Ethernet or Token Ring network. The web camera is arranged to produce digital images at a given rate, such as 1-25 images per second. In order to increase the visual volume covered by the web camera, the camera is 30 provided with mechanical means for panning and/or tilting the camera. Generally speaking, "panning" means rotating the camera by a given angle (normally 0°-360°) in a horizontal plane, and "tilting" means rotating the camera by a given angle (normally 0°-180°) in a vertical plane.

35 In prior art web cameras the panning and/or tilting functionality is obtained by moving the whole camera or at

least the objective thereof. Since the camera and objective have a considerable weight, such an approach involves complex, large and expensive mechanics. Furthermore, the speed at which the camera may be panned or tilted is 5 restricted due to the large mass, that has to be moved accordingly.

Summary

It is an object of the present invention to provide a 10 digital camera, which allows faster and more accurate panning and/or tilting, thereby allowing the camera to produce more images per time unit. Furthermore, it is an object of the present invention to provide an image 15 rotating device, to be mounted externally to the digital camera, for providing efficient and rapid panning and/or tilting functionality, without requiring large or expensive mechanics.

The above objects are achieved by providing the 20 digital camera with an image rotating device having a mirror mounted externally to the camera housing and having a rotational member for rotating the mirror with respect to the optical input (lens or objective) of the camera housing in response to an angular displacement control signal received from a controller of the digital camera.

25 Other objects, features and advantages of the present invention will appear from the following detailed disclosure, from the appended claims as well as from the drawings.

30 Brief Description of the Drawings

A preferred embodiment of the present invention will now be described in more detail, reference being made to the accompanying drawings, in which:

FIG 1 is a schematic block diagram of the overall structure of a digital camera according to the preferred embodiment,

5 FIG 2 is a first sideview of the image rotating device and the camera, to which it is mounted,

FIG 3 is a second sideview of the image rotating device and the camera shown in FIG 2, and

FIG 4 is a topview of the image rotating device shown in FIGs 2 and 3.

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Detailed Disclosure

Referring to FIG 1, a digital camera 300 is illustrated in a basic modular form. The digital camera 300 is arranged to produce one or several digital image(s) of a generic object 100, which may be any physical object that is present in a volume optically covered by the digital camera 300. An inventive image rotating device 200 is mounted externally to the digital camera 300 in front of an optical input 400 of the digital camera. The optical input 400 is a generally known lens or objective. The purpose of the image rotating device 200 is to extend the available field of view of the digital camera 300 in at least one plane, preferably in a horizontal plane as well as in a vertical plane. A preferred embodiment of the image rotating device 200 will be described in more detail with reference to FIGs 2-4.

As shown in FIG 1, the digital camera 300 further comprises an image capturing unit 500, which is provided with appropriate means for producing a digital image representative of the object 100. Preferably, the image capturing unit 500 comprises a CCD element (Charge Coupled Device), the internal structure of which is believed to be well-known to a man skilled in the art. The digital camera 300 also has a controller 600 for controlling the image capturing unit 500 as well as the external image rotating

device 200. The controller 600 is operatively connected not only to the device 200 and the unit 500 but also to a digital memory 700 for storing images captured by the image capturing unit 500. Furthermore, the digital camera 300 may 5 comprise an image transforming unit 800, the purpose of which is to rotate the digital image to compensate for image rotating effects caused by the image rotating device 200, when the field of view is panned or tilted. The image transforming unit 800 is responsive to an angle of rotation 10 of the image rotating device 200 with respect to the objective 400 and uses this angle of rotation when transforming the digital image to compensate for the current pan and/or tilt angle. To perform such image transforming, i.e. to rotate a digital image in one or more than one direction, 15 is believed to be well within reach of a man skilled in the art of digital cameras. Therefore, the internal structure of the image transforming unit 800 will not be described herein.

The memory 700 may be implemented by any commercially 20 available memory, such as an EEPROM memory.

As indicated in FIG 1, the digital camera 300 may be connected to a network 900, such as an Ethernet or Token Ring network, which in turn may be part of the Internet. In such an application, the controller 600 of the digital 25 camera 300 is provided with appropriate software for allowing the digital camera 300 to act as a web camera available on the network 900, i.e. a web server that produces digital images.

The pan and/or tilt angle of the digital camera 300, 30 or more specifically the angle(s) by which the image rotating device changes the field of view of the camera 300 with respect to a central axis of the objective 400, may be set and changed by a user of the camera by accessing the controller 600 through the network 900. Alternatively, the

pan and/or tilt angle(s) may be controlled from a computer directly connected to the digital camera 300.

A preferred embodiment of the image rotating device 200 will now be described in more detail with reference to FIGs 2-4. The following elements are shown in these drawings:

Qty	Ref. No.	Name
1	19	Frame
1	18	Timing belt tightener
1	17	Belt wheel
1	16	Timing belt
1	15	Belt wheel
1	14	Timing belt
1	13	Timing belt tightener
2	12	Optical sensor
1	11	Mirror holder
1	10	Tilting mirror
1	9	Fixed mirror
1	8	Camera lens (objective)
2	7	Motor
1	6	Camera housing
1	5	Mirror wheel
1	4	Bevel gear
1	3	Tilt shaft
2	2	Fixing part
1	1	Guiding wheel

The image rotating device 200 has a mirror system, comprising a first fixed mirror 9 and a second tilting mirror 10. The fixed mirror 9 is mounted directly in front of the objective 8 at an angle of 37° relative to the

optical center axis of the camera 300. The fixed mirror 9 is mounted to a mirror wheel 5, which is rotatable around the objective and hence provides a field of view with an angle of rotation of between 0° and 360°.

5 In the center of the field of view the tilting mirror 10 is mounted, so that the axis of rotation thereof is perpendicular to the optical center axis of the camera. The tilting mirror 10 is carried on the mirror wheel 5, thereby causing the tilting mirror 10 to rotate around the objective 8 together with the fixed mirror 9. Thanks to the 10 geometrical arrangement of the mirrors 9 and 10 with respect to the objective 8, it is possible to monitor a large volume in a short time.

The tilting mirror 10 is attached to a mirror holder 11, which in turn is journalled in the mirror wheel 5 between two fixing parts 2. Opposite to the mirror wheel 5 a slightly smaller guiding wheel 1 is concentrically mounted. A tilt shaft 3 is eccentrically mounted to the mirror wheel, so as to cause the tilting mirror 10 to move. 15 The guiding wheel 1 transmits its motion to the tilt shaft 3 and from the tilt shaft 3 through a bevel gear 4 to the mirror holder 11. The arrangement resembles a planetary gear, where the guiding wheel represents a sun pinion and the tilt shaft represents a planet pinion. The mirror wheel 20 acts as holder of the planet pinion.

When the mirror wheel does not move, if the guiding wheel is rotated, the tilt shaft 3 will rotate around its own axis, wherein the mirror holder 11 will be rotated around its axis of rotation. Hence, the tilting mirror 10 25 is rotated with respect to the mirror wheel 5, and the center axis of the field of view will be angled with respect to the optical center of the camera. If the mirror wheel 5 and the guiding wheel 1 rotates at the same angular velocity, there will be no relative motion in the tilt shaft and consequently no rotation of the mirror 30 35

holder/mirror around its axis of rotation. However, the mirror wheel 5 as a whole will rotate with the fixed mirror 9 and the tilting mirror 10 at a constant angle to the optical center axis of the camera.

5 In other words, by rotating the mirror wheel 5 and the guiding wheel 1 synchronously, the field of view may be rotated 360° for any given tilt angle. Then, if the wheels are rotated relative to each other, the angle of the mirror holder 11 will change, and the field of view may be again 10 be rotated 360° for a new tilt angle. In this way, a very large volume around the camera may be covered, and images may be obtained for any given location within this large volume.

15 The mirror wheel 5 and the guiding wheel 1 are driven by respective motors 7. Belt wheels 15, 17, timing belts 14, 16 and timing belt tighteners 13, 18 are provided, as shown in FIGs 2-4.

The inventive image rotating device provides at least the following advantages:

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- Low moment of inertia for rotating parts
- High pan/tilt adjustment speed, short time between angular settings
- High setting accuracy
- Compact design
- Few structural components
- Low manufacturing cost
- Flexible design
- Simple pan/tilt control
- Wide field of view

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30 The present invention has been described above with reference to a preferred embodiment. However, other embodiments than the one disclosed herein are possible within the scope of the invention, as defined by the appended independent patent claims.

CLAIMS

1. A digital camera (300) having panning and/or tilting functionality, comprising: a camera housing (6) with an optical input (400), such as a lens or objective (8); an image capturing unit (500) for producing a digital image from light received through the optical input; a controller (600); a first mirror (9) mounted externally to the camera housing (6); and an image rotating device (200), which is connected to the controller (600) and is adapted to rotate the first mirror at an angle of rotation with respect to the optical input (400, 8) of the camera housing (6), **characterized by**

15 an image transforming unit (800), which is connected to the image capturing unit (500) and is adapted to rotate the digital image, as captured by the image capturing unit (500), by an angle related to the angle of rotation of the first mirror (9).

20 2. A digital camera as in claim 1, further comprising a second mirror (10) mounted externally to the camera housing (6), wherein the image rotating device (200) is adapted to rotate the second mirror at a second angle of rotation with respect to the optical input (400, 8) of the camera housing (6).

30 3. An image rotating device (200) for a digital camera (300) having a camera housing (6), an optical input (400), such as a lens or objective (8), and an image capturing unit (500) for producing a digital image from light received through the optical input, the image rotating device comprising a first mirror (9) mounted externally to the camera housing (6), and a first rotational member (5, 7) for rotating the first mirror at a first angle of

rotation with respect to the optical input (400, 8) of the camera housing, **characterized by**

a second mirror (10) mounted externally to the camera housing (6); and

5 a second rotational member (3, 7) for rotating the second mirror at a second angle of rotation with respect to the optical input (400, 8) of the camera housing.

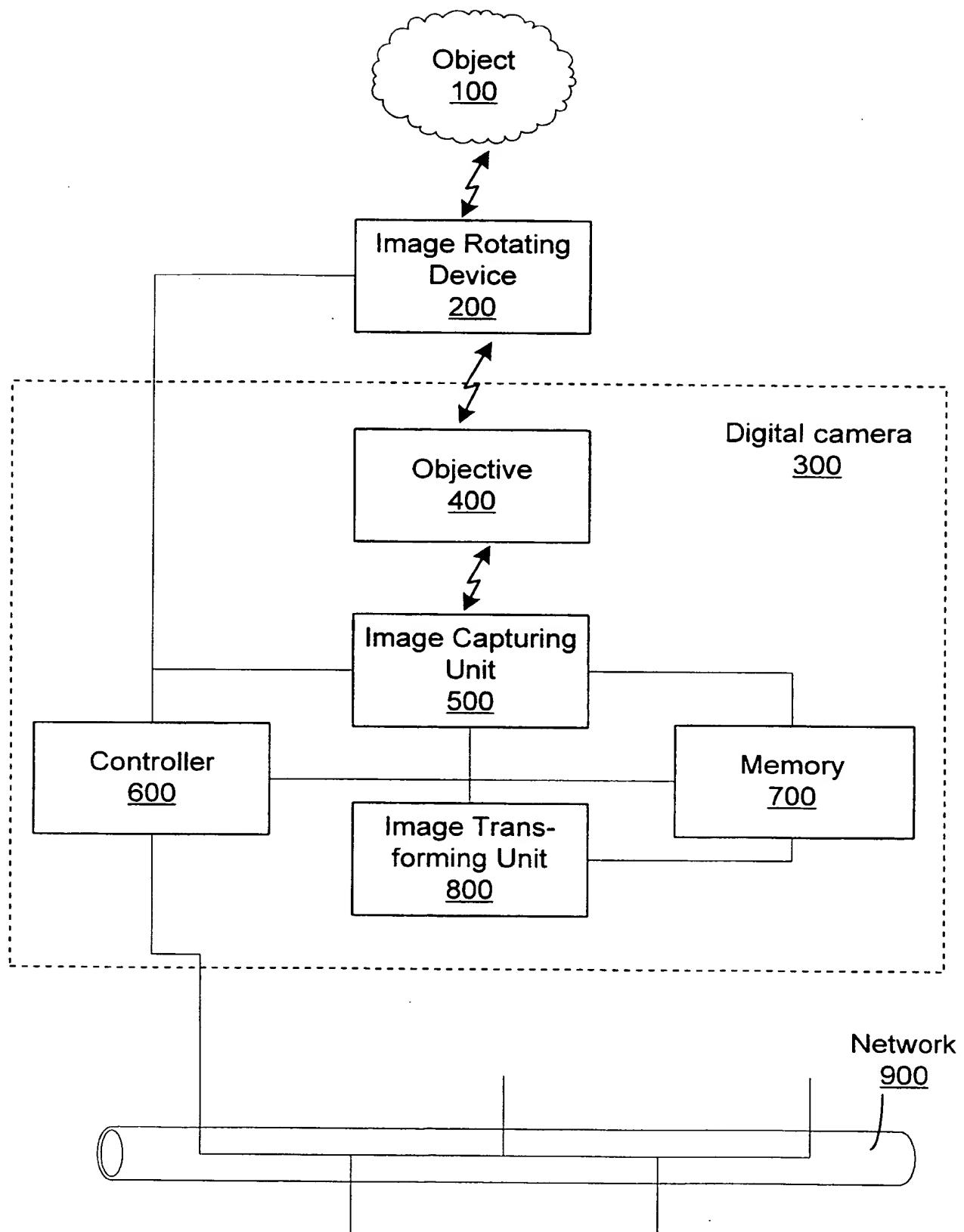


FIG 1

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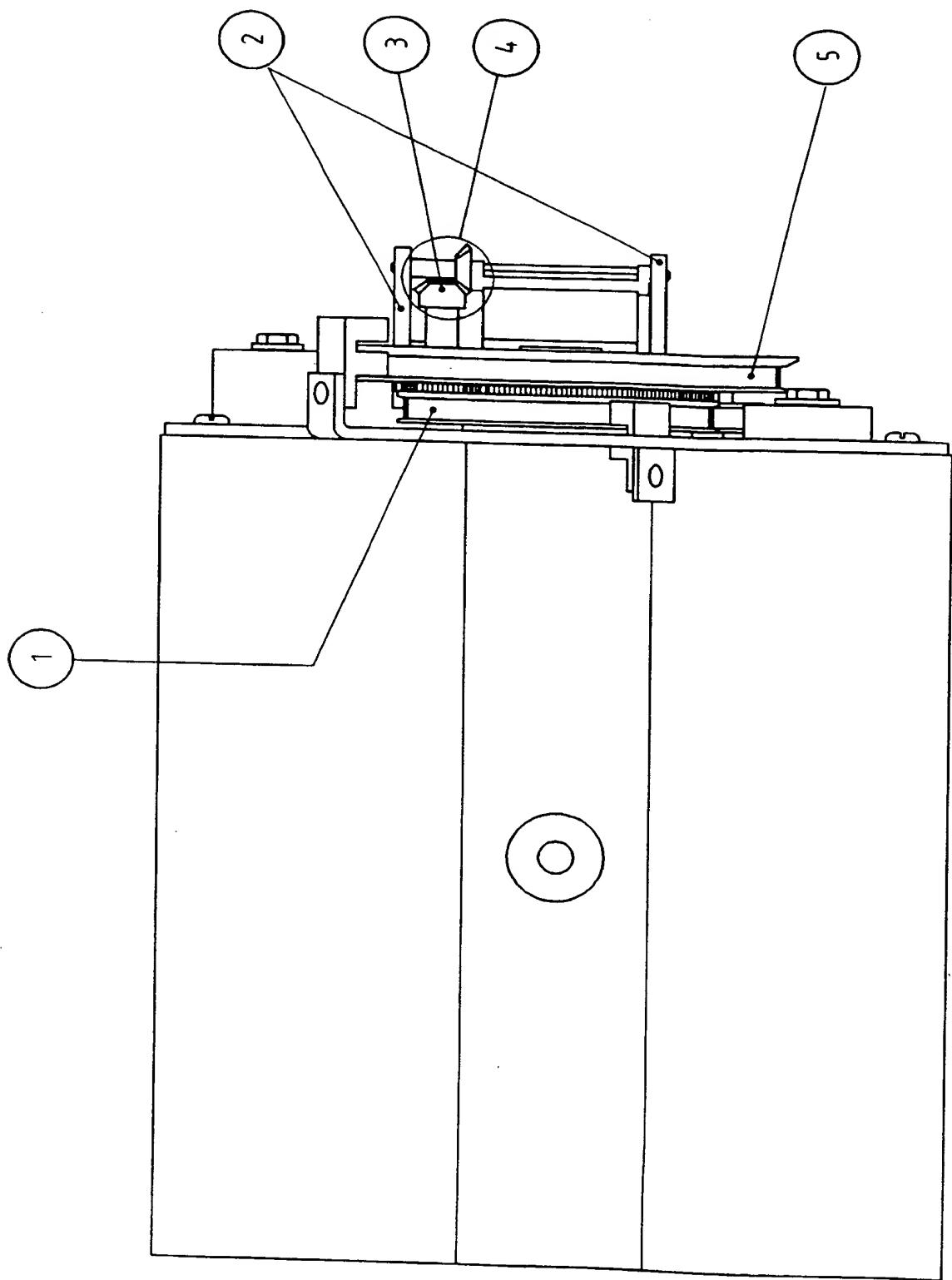


FIG 2

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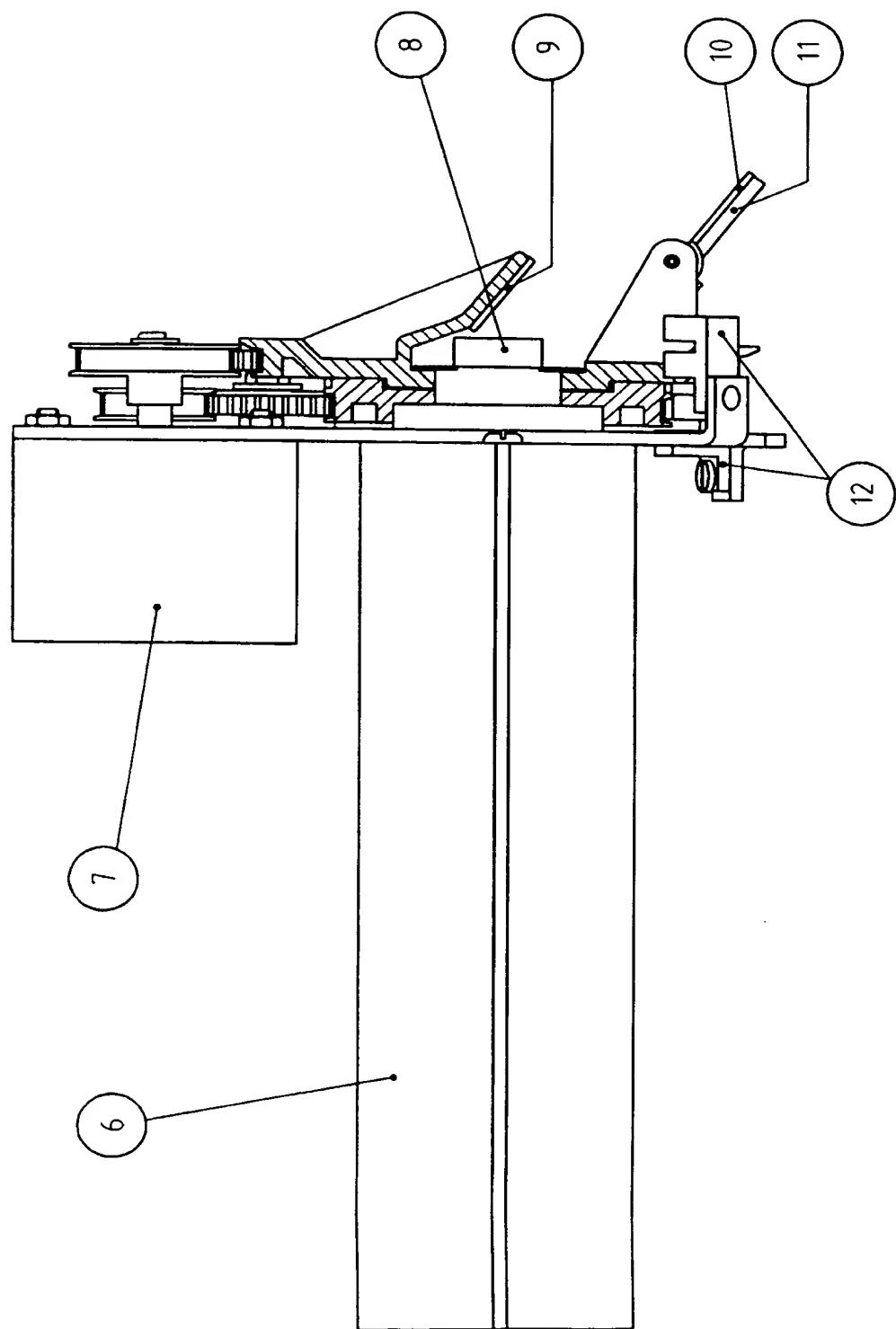


FIG 3

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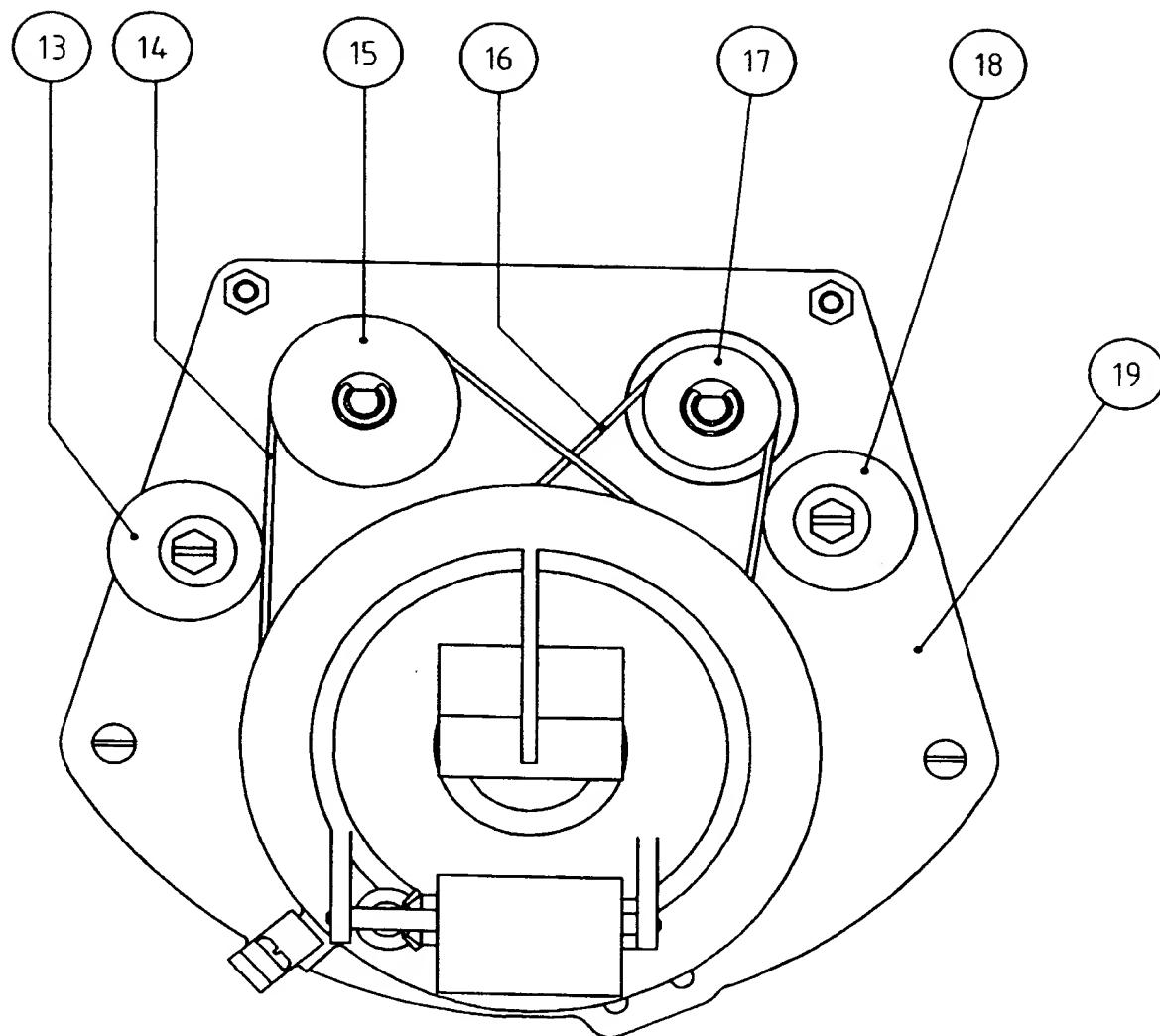


FIG 4

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INTERNATIONAL SEARCH REPORTInternational application No.
PCT/SE 00/00522

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G03B 37/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G03B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5717512 A (CHMIELEWSKI, JR. ET AL), 10 February 1998 (10.02.98) --	1-3
A	US 3868706 A (STEINGOLD), 25 February 1975 (25.02.75) --	1-3
A	US 4499490 A (MORGAN), 12 February 1985 (12.02.85) --	1-3
A	US 5606368 A (CORRADINI), 25 February 1997 (25.02.97) -----	1-3

 Further documents are listed in the continuation of Box C. See patent family annex.

- * Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT
Information on patent family members

02/12/99

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5717512 A	10/02/98	AU 3006297 A WO 9743677 A	05/12/97 20/11/97
US 3868706 A	25/02/75	NONE	
US 4499490 A	12/02/85	NONE	
US 5606368 A	25/02/97	NONE	